CASE REPORT

Teflon Granuloma of the Skull Base: A Complication of Endonasal Brain Surgery

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ABSTRACT

Teflon granuloma is an inflammatory giant-cell foreign-body reaction to polytetrafluoroethylene fibers or injection. Tissue augmentation with Teflon has dramatically declined over the past two decades because of its implication in granuloma formation. Nevertheless, Teflon felt is still commonly used in neurosurgical dissection and microvascular decompression. We report a patient with a Teflon granuloma of the skull base discovered 1.5 years after endonasal resection of an olfactory groove meningioma. The case highlights the clinical and radiographic diagnosis as well as the management of this unusual finding.

KEYWORDS: Teflon granuloma, endonasal neurosurgery, meningioma, skull base

Until the 1980s, many surgical fields used Teflon to treat disorders that would benefit from additional tissue bulk. Commonly augmented areas have included the paralyzed vocal cord, the posterior pharynx in velopharyngeal insufficiency, and the periurethral region for incontinence. Today Teflon use is significantly limited due to its causative relationship with granuloma formation. Teflon granulomas of the vocal cords have been reported frequently and are associated with significant vocal dysfunction that persists even after surgical correction.[1] Teflon granulomas, both clinically and radiographically, can emulate malignancy. In particular, they have been confused radiographically with tumor recurrences in the larynx and pharynx.[2–4] Adverse reactions from Teflon have also been reported in frontalis muscle suspension, implants in temporomandibular joint surgery, microvascular decompression for trigeminal neuralgia, and pericardial closure in rheumatic heart surgery.[5–8]

Teflon felt is still used in neurosurgical dissection to displace and protect neurovascular structures for microvascular decompression of cranial nerves and to facilitate tumor dissection. We report an unusual case of a Teflon granuloma of the skull base incidentally discovered 1.5 years after endonasal resection of a large frontal meningioma.

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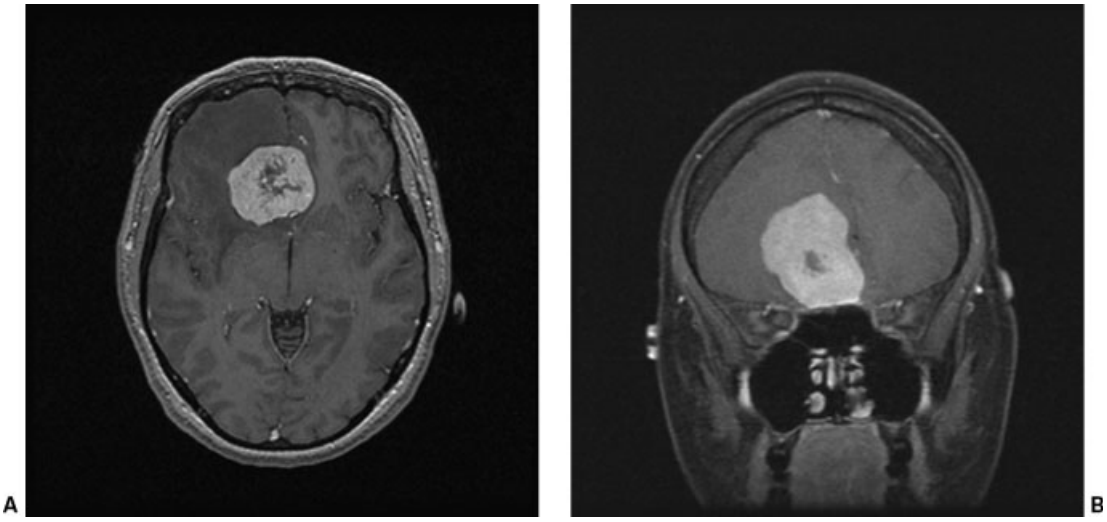

Figure 1 Preoperative (A) axial and (B) coronal T1-weighted MRIs show a 4-cm homogeneous extra-axial mass with central necrosis, consistent with a meningioma.

CASE REPORT

A 35-year-old otherwise healthy woman had a 1-year history of progressive headaches and visual loss. Ophthalmologic examination revealed severe papilledema. MRI showed a 4-cm homogeneous extra-axial mass, consistent with a meningioma, arising from the planum sphenoidale (Fig. 1). She was admitted to the hospital for steroid therapy and subsequent surgical management.

The patient underwent a staged endoscopic craniofacial resection of the meningioma with image guidance as previously described.[9] During the first stage, the optic nerves were decompressed and about 50% of the tumor was debulked. One day later, the remainder of the tumor and its capsule were resected through the same approach, preserving the anterior cerebral vessels. Intermittently, Teflon felt was used to assist with the dissection of tumor from cerebral vessels. At the end of the case, the Teflon felt was left in place due to the difficulty of retrieving it from the deep resection cavity. An onlay cadaveric pericardial graft was placed and augmented with fibrin glue. Abdominal fat grafts were used to cover the skull base and to fill the sphenoid defect. Additional fibrin glue and nasal tampons were placed to support the grafts.

The patient's postoperative course was uncomplicated. The acute visual loss in her left eye resolved although only light perception remained in her right eye. Immediate postoperative CT showed complete tumor resection with no hemorrhage or brain injury. She was discharged to home on postoperative day 9.

Two months later, the patient underwent a routine ophthalmologic examination that showed asymptomatic papilledema. A lumbar drain was placed, and she was started on antibiotics. Although her white blood cell (WBC) count was elevated in her cerebrospinal fluid (CSF), she remained afebrile and asymptomatic with a normal systemic WBC count and negative CSF cultures. Further evaluation showed no clinical or radiographic evidence of infection or tumor recurrence (Fig. 2). Nevertheless, because of persistently elevated intracranial pressure and the risk of visual loss in her only sighted eye, a ventriculoperitoneal shunt was placed. Over the next 18 months, her vision remained stable with no clinical or radiographic signs of complications or tumor recurrence.

Unexpectedly, on routine follow-up MRI 1.5 years after surgery, the patient was found to have a large, multilocular, ring-enhancing, cystic mass in the medial aspect of the left frontal lobe with

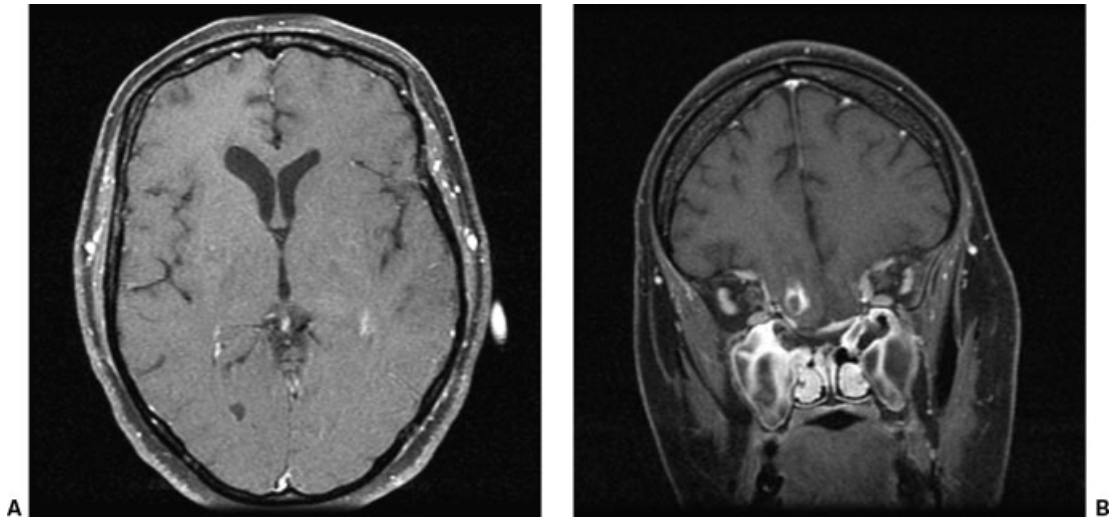

Figure 2 Postoperative (A) axial and (B) coronal T1-weighted MRIs 2 months after endonasal tumor resection show minimal residual enhancement in the surgical bed.

surrounding edema (Fig. 3). The collection measured 5.3 × 3.1 cm and extended from the anterior skull base, in the area of the original surgical approach, superiorly to the corpus callosum. The patient remained asymptomatic and afebrile with no visual changes and a normal WBC count. She underwent CT-guided stereotactic aspiration of the lesion. Cultures grew methicillin-sensitive *Staphylococcus aureus* and the patient began a 6-week course of intravenous nafcillin.

During admission, the patient was also seen by the otolaryngologist for nasal debridement and endoscopic examination. She was noted to have intense inflammation and granulation tissue at the

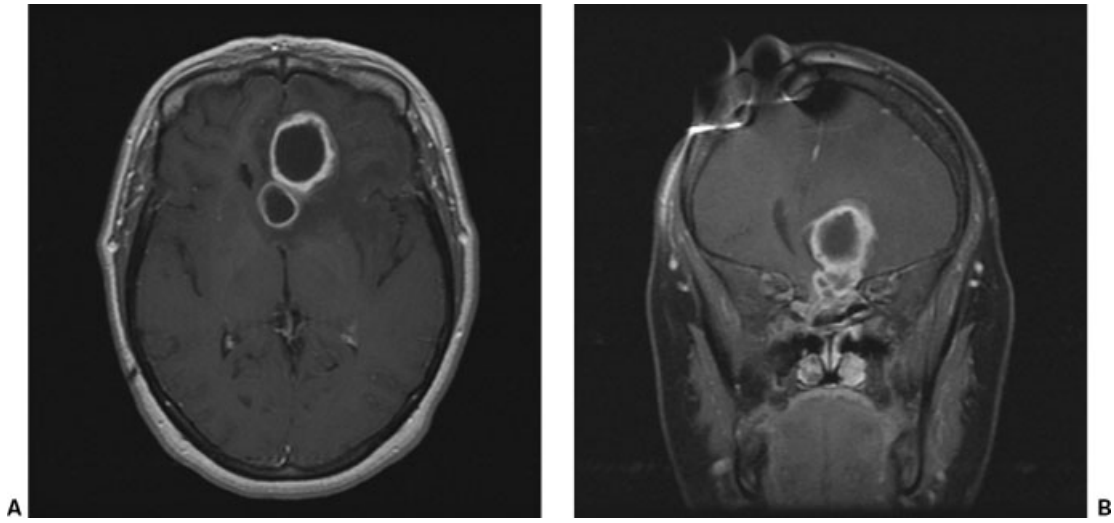

Figure 3 Postoperative (1.5 years) (A) axial and (B) coronal T1-weighted MRIs show a 5.3- × 3.1-cm multilocular, ring-enhancing, cystic mass in the medial aspect of the left frontal lobe with surrounding edema.

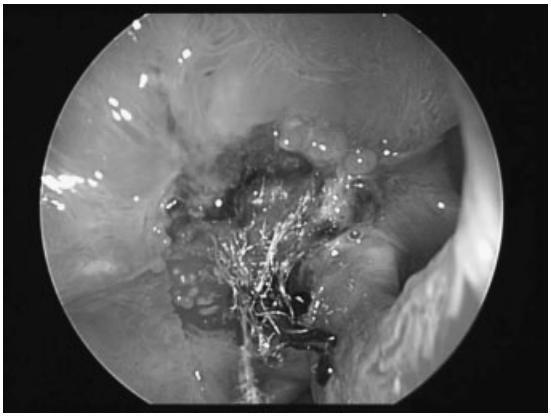

Figure 4 Nasal endoscopy of the planum sphenoidale shows the fibers and surrounding inflammation and granulation tissue characteristic of a Teflon granuloma. At the right side of the image is the free edge of the posterior septum.

skull base in the area of the planum sphenoidale. Nasal endoscopy was continued in the operating room with image guidance under general anesthesia to improve her comfort and safety. Further exposure in the suprasellar region revealed the fibrous strands characteristic of Teflon felt (Fig. 4).

The fibers of the Teflon felt were gently freed from the surrounding tissue. The granuloma was bluntly dissected from the reconstructed skull base, which remained intact throughout the procedure. Approximately 1 cc of Teflon granuloma was removed and submitted for both microbiological and pathological analysis. Pathology confirmed the presence of a Teflon granuloma. A follow-up MRI obtained 3 months later showed near-complete resolution of the abscess and inflammation. The patient remained asymptomatic with stable vision and no evidence of tumor recurrence.

DISCUSSION

This is the first documented case report of a Teflon granuloma of the anterior skull base after endoscopic tumor resection. In this case, a Teflon granuloma of the skull base with an associated brain abscess was discovered more than 1.5 years after endoscopic resection of a large olfactory groove meningioma via the expanded endonasal approach. The abscess and skull base inflammation resolved within 3 months of removal of the granuloma and treatment with antibiotics. We hypothesize that the exposed Teflon at the site of the skull base reconstruction promoted bacterial infection of the granulomatous tissue and abscess formation.

In the early 1980s, Teflon (polytetrafluoroethylene) enjoyed widespread use in many areas of medicine, particularly otolaryngology and urology.[10] Teflon's promise stemmed from the idea that it was a stable, inert substance that would not resorb or migrate. Therefore, it was used to provide long-term tissue bulk in otherwise deficient areas. Examples include the periurethral area for urinary incontinence, the posterior pharynx for velopharyngeal insufficiency, and the true vocal fold for vocal cord paralysis. By the early 1990s, however, as a result of its implication in granuloma formation, tissue augmentation with Teflon diminished dramatically.[11,12]

Early histologic studies of Teflon injections in animal larynges suggest that Teflon causes an intense inflammatory reaction that lasts as long as 2 months.[13,14] This acute inflammatory response may correlate with our patient's elevated CSF WBC count, papilledema, and increased intracranial pressure that resulted in placement of a ventriculoperitoneal shunt 2 months after her surgery. Dedo and Carlsoo subsequently observed that a granulomatous reaction, characterized by activated macrophages, multinucleated giant cells, and dense collagenous tissue, predominates 3 to 6 months after injection.[15]

Teflon felt is still used in neurosurgical procedures to assist with dissection and to treat neurovascular compression syndromes.[7,16,17] Chen and colleagues reported five cases of Teflon granuloma after microvascular decompression for trigeminal neuralgia.[7] In their series, 89 patients with trigeminal neuralgia underwent microvascular decompression using Teflon felt to separate the offending vessels from the trigeminal nerve. Five of the 89 patients developed a Teflon granuloma that caused their

symptoms to recur 1 to 12 months after surgery. In all five cases, reoperation and excision of the Teflon granuloma resulted in complete resolution of symptoms. Based on intraoperative findings, the authors postulated that the foreign-body granulomatous reaction in these five patients was caused by the Teflon directly contacting the tentorium or dura. In our case, the Teflon granuloma was also directly adherent to the reconstructed dura, possibly supporting Chen's insights into the pathophysiology.

Nevertheless, because of the significant decline in the overall use of Teflon and because granulomas are only reported to occur in 1 to 5% of cases, Teflon granulomas remain uncommon.[7,17,18] Knowledge of the patient's prior surgical history and a high level of suspicion are essential to suggesting the diagnosis. Radiographic diagnosis, especially with CT or PET/CT, is often difficult due to confusion with neoplastic and infectious processes.[2–4] MRI can help confirm the presence of a Teflon granuloma. The characteristic chronic fibrosis is usually a low-to-intermediate T2-weighted signal intensity; in contrast, carcinoma should be associated with increased T2-weighted signal intensity.[2]

As in this case, endoscopy with direct visualization, if possible, is the most useful tool for confirming the diagnosis. Based on our case and prior reports of managing Teflon granulomas, treatment is best accomplished by excision of the granuloma and the offending Teflon fibers.[1,7,10,12,16] Nevertheless, the ultimate management strategy involves preventing the formulation of Teflon granulomas by minimizing its use and developing new materials to replace it. We do not advocate the use of Teflon felt in endonasal brain surgery due to the risk of communication with the nasal cavity and bacterial contamination.

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Commentary

The authors report a patient who developed a brain abscess and a Teflon felt granuloma after staged endoscopic craniofacial resection of an olfactory groove meningioma.

The authors hypothesize that the Teflon felt caused an inflammatory reaction of the skull base 3 months after surgery and contributed to the development of a brain abscess discovered more than 1.5 years after surgery. They present a nice review of the adverse effects of Teflon felt.

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